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ABSTRACT

The Supplemental Instructional Program (SIP) is an academic support program of Southern Illinois University at Edwardsville (SIU-E). It was started in response to the needs of minority disadvantaged students, who showed a high attrition rate in science and engineering. It aimed to prepare these students for survival in the system by providing a conceptual and skill base for further studies, and to motivate them to pursue careers in science, engineering, and medicine. Accordingly, SIP implemented an Acceleration Program in Science and Technology (APST). The first of three interdependent schemes of APST is a remedial mathematics program based on the Quasi-Modular Approach (QMA), which combines counseling, tutorial facilities, and conventional lectures with workshop sessions. This scheme is phased into the standard curricula of the School of Science and Technology of SIU-E. Detailed short term statistics are presented to assess its effectiveness. They show the success of QMA in preparing the disadvantaged student. The other two interdependent schemes of APST, an extension course program, with full college credit, to motivate students in area high schools and a science awareness program in high schools, are discussed briefly. (Author/AM)

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PRESENTATION

ACCELERATED PROGRAM IN MATHEMATICS FOR DISADVANTAGED STUDENTS

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Introduction to an Acceleration Program in Science and Technology for the Disadvantaged‡‡

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Summary

The number of students called the 'disadvantaged' for reasons of income, or ethnicity etc. is substantially increasing in the American higher educational system. However, the prospects for survival of these students in the universities and for their successful completion of requirements for degrees in science and engineering are discouraging. A large segment of these students, through no fault of their own, receive a high school training which is not only substandard but is showing signs of gradual erosion in quality. An academic support program of Southern Illinois University at Edwardsville (SIU-E), the Supplemental Instructional Program (SIP), recognizes that this situation warrants a comprehensive approach in meeting their needs -- i) to prepare them for survival in the system by providing a conceptual and skill base for further studies, preferably in science and engineering, ii) to help well motivated disadvantaged students pursue careers in science, engineering, and medicine. Accordingly, SIP proposed, developed and implemented an Acceleration Program in Science and Technology (APST). Three interdependent schemes of APST are: i) a remedial mathematics program based on the Quasi-Modular Approach (QMA), which involves a coordination of counseling, tutorial facilities, and conventional lectures with built-in workshop-sessions, ii) an extension-course program, with full college credit, to motivate students in area high schools and iii) a science awareness program in high schools that provides year-round enrichment instruction within the teaching-format of the high school system. This paper is basically concerned with the first scheme which is phased into the standard curricula of the School of Science and Technology of SIU-E. Detailed short-term statistics are presented to assess the effectiveness of the first scheme. The data pertain to the comparative performance-evaluation between disadvantaged students, and the total population

concerning pre-college preparation, attrition, grade distribution and responses to follow-up mathematics courses. This data appraisal shows that APST has enabled disadvantaged students to pass successfully the required math courses without the indignities that surround remediation. With reference to the other two schemes of APST, a follow-up study is presently in progress which mostly concerns another segment of disadvantaged students who, though motivated and not in need of remedial preparation, are deprived of specially structured curricula and specially selected instructors who could develop the latent potential of these students for careers in science and engineering.

1. Introduction

In varying degrees institutions of higher learning are also social institutions. They have to accept, explicitly or implicitly, their responsibility to identify and to search for solutions to many of the complex socio-educational problems which plague our society. Indeed, some universities have explicit commitments to respond to the needs of their service areas; in the case of SIU-E, e.g., the needs of disadvantaged students from inner city high schools. In recent years some universities did initiate several efforts for these students--virtual open enrollment procedures, special scholarship programs, etc. As a result, the number of disadvantaged students has substantially increased in the universities.[1-5] At SIU-E, the enrollment of minority students alone has increased from 7% to 17% from Fall 1971 through Fall 1975.

Most of these students, due to economic and subtle ethnic reasons, receive a substandard high school training.[6] Even this substandard training appears to be gradually eroding in quality, almost in direct proportion to the increasing efforts by some universities to attract disadvantaged students. Due to their inadequate preparation, particularly in mathematics and English, and due to the lack of counseling in the universities, tailored to ethnic minority problems, these students require special handling.[4,7,8] They find themselves disadvantaged within their freshman class. They barely survive in the traditional educational system geared to the so-called "mature college-bound" students.

Another interrelated and equally disquieting situation is the imbalance in minority representation in applied sciences. United States

labor force statistics for the year of 1973 show that there were 735,000 persons employed in engineering and related science-technical occupations, of which 23,000 were minority employees -- about 3.1% of the total work force. In 1972, out of 44,190 engineering graduates only 405 were black--less than 1% of graduating engineers. In 1973, Illinois had 16,153 doctors, of whom 378 were black -- a little more than 2%. A statistical report of the United States Labor force in the medical and health related occupations revealed that 1.8% of this labor force was black. During the last three years our major effort at SIU-E has been directed at decreasing the number of blacks that concentrate in the fields of education and social services and increasing the number that pursue degrees in the sciences and engineering. An out-come of this effort is depicted in the following:

Year	% of Black Students Receiving Degrees from School of Education & School of Social Sciences	Number & Percentage with Degrees from School of Science and Technology	
		No.	%
1972	74	3	N/A
1973	70	5	3.6
1974	65	6	4.5
1975	54	10	9.0

Today the above two interrelated situations have become a matter of national concern. However, as early as in 1971 SIU-E was taking steps to correct it through a program called the Supplemental Instructional Program (SIP).

2. Description of Supplemental Instructional Program (SIP)

SIP at SIU-E had its genesis in 1971, growing out of an increasing commitment on the part of the University to meet the educational needs of its constituents from the Metro-East area. SIP was designed to counterbalance the "failure syndrome" exhibited by the minority and culturally different population of the Madison-St. Clair County area (which has consistently been listed among the nation's top ten poverty areas) and to increase University enrollment from this area. An examination of enrollment and performance data of Southern Illinois University at Edwardsville reveals that, of the relatively small number of Metro-East students enrolled prior to the inception of SIP, 90 percent failed to complete a baccalaureate education. The SIP, therefore, was originated to provide carefully designed support systems for a quality academic program and, thus, to lower the attrition ratio. Moreover, the support system makes possible an educational experience that maximizes the success potential of this minority and culturally different population.

SIP is founded on the philosophy that success in an academic educational program is possible and probable for highly motivated, low-income students if they are given an alternative educational system founded on cognitive and effective support systems. SIP's objectives are:

a) to provide to disadvantaged and probationary students a university admissions program strengthened by tailored systems (counseling, tutoring, curriculum additions, etc.) to enhance their potential for success.

b) to provide the University an increased capacity for assisting students who encounter difficulty in their academic programs,

c) to reduce the over-all attrition rate, and

d) to broaden the University's response to the needs of the surrounding community by supplementing its resources and expertise.

In order to accomplish these objectives, the SIP program has six components in operation: a) recruitment with a modified selection process, b) counseling and academic advisement, c) tutoring facilities, d) tailored curricula where necessary, e) financial assistance, and f) placement service.

A study of the data compiled during its first four years indicated that SIP has developed a successful program in terms of its objectives. Since its inception in 1971 our enrollment has increased by 500 percent, and 325 SIP students have been graduated by SIU-E.

3. The Acceleration Program in Science and Technology (APST)

A continuing process at SIP, since its inception in 1971, is the documentation of its research pertaining to the needs of SIP and other disadvantaged students from the Metro East Area, of its experiences pertaining to recruiting, counseling and tutoring, and of accumulated data pertaining to the performance appraisal of its students. This process demonstrated the desirability of a pilot program with particular reference to highly motivated and dedicated disadvantaged students who want to achieve in the areas of Science and Technology. As a result, Summer 1974 saw the introduction of this pilot program called APST designed and implemented by SIP with the cooperation of the School of Science and Technology of SIU-E. APST is designed to provide precollege and college experiences for students who have ability and who can benefit from advanced preparation through specially structured curricula and specially selected instructors who can develop the latent potential of these students for careers in science and engineering. Accordingly, the goals of APST are:

1) to identify the capable high-ranking students who are seriously motivated and interested in the fields of science and technology;
2) to provide learning experiences that prepare and motivate students to continue their training in health- and science-related professions;
3) to increase the number of minority students in professional schools in health- and science-related areas;
4) to establish and develop a cooperating and coordinated program with the high schools which will identify and provide preparatory training for precollege students.

Bypassing details of administrative and academic subtleties, the working format of APST could be briefly described as follows: A student in APST is admitted into the program on the evaluation of the APST staff, rather than on ACT scores. The student has the advantage of a specially-selected professional staff as instructors, and the curriculum structured to meet the needs of the students from the Metro-East area. APST students have access to counselors as needed; and tutoring is available upon demand. APST is assisting program participants in obtaining admission to dental, medical, engineering and other graduate programs in the physical and biological sciences and mathematics.

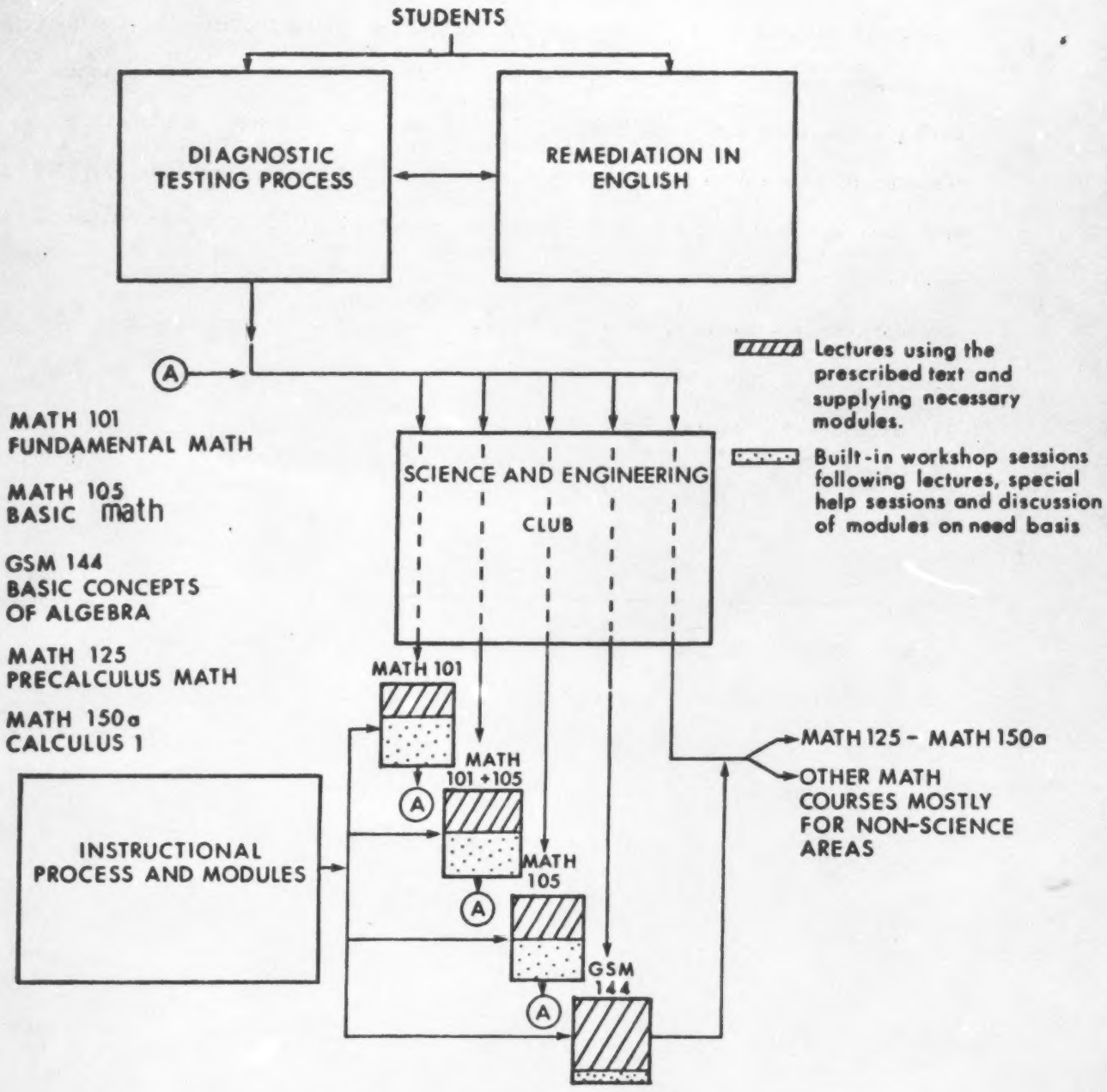
4. A Learning System

As stated earlier, APST is intended to prepare disadvantaged students to accommodate to the rigors of science training at the university level and to develop professional careers in science, technology, and health related areas. The first step towards achieving these objectives will be to demonstrate 1) that such students can successfully compete in the regular curricular programs of the School of Science and Technology, and 2) that they have the necessary orientation towards developing these professional careers. Quasi Modular Approach (QMA) is this first step, which is a comprehensive learning system based on the benefit of past experiences of failures and successes at SIU-E and elsewhere. For a detailed description of QMA see references 7 and 8. For completeness, a brief account of QMA is given in the sequel with reference to remediation in mathematics since mathematics provides a basis for all science and technology. The development of analogous approaches in the Reading Skills area is presently in progress.

At SIU-E which operates on a quarter basis, the first regular course in mathematics is GSM 144 Basic Concepts of Algebra, a traditional course in College Algebra. To remedy deficiencies in high school mathematics, a two quarter sequence in precollege mathematics is introduced--i) Math 101, Fundamental Mathematics which starts with basic concepts of arithmetic and concludes with elementary algebra, and ii) Math 105, Basic Mathematics which provides adequate preparation to take GSM 144. Math 105 bridges the gap between the essentially intuitive and manipulative approaches in high school mathematics and the more rigorous treatment of college algebra. Thus, in combination with Math 125, Precalculus Mathematics, the present scheme permits a student to take 4 quarters of mathematics to provide a natural transition to Calculus.

As shown schematically in the block diagram in Figure 1, QMA has four components--i) a Diagnostic Testing Process, ii) Remediation in English, iii) Instructional Process and Modules, and iv) the Science and Engineering Club.

Diagnostic Testing Process: It is designed to assess the duration of remediation with the help of two diagnostic tests. Appropriate class level tests were administered on the first day of the class, and on the second day the students were informed of their test results. For example in College Algebra in Fall '76, when 1200 students went through this testing process, a student was considered to have the prerequisites if the score was between 40% and 85%. A score lower than 40% (under qualified) indicated the need to take Math 105, Basic Mathematics or in some cases Math 101, Fundamental Mathematics. A score higher than 85% (over qualified) indicated that the student could take Math 125 Pre-Calculus mathematics. A similar format was followed in Math 105 and Math 101. Since Math 101 is the first course in pre-college algebra, the diagnostic test is given to identify over-qualified students. Test results are used to compare their actual preparation with the required prerequisites, and thereby assess how far the mathematics background of students in Math 101 is heterogeneous. (This problem of heterogeneous background is touched upon subsequently while discussing the instructional process with the help of modules.) Those students who were over or under qualified in Math 105 and in GSM 144, and over qualified in Math 101 or those who were absent, were given appropriate higher or lower level tests administered in a centralized testing center. This second test (higher or lower) differed from the first in that it was designed to pinpoint the precise course the student should take. It was given at each hour of the third



A SCHEMATIC REPRESENTATION OF QMA

Figure 1.

day so the students would not lose more than one contact period by taking diagnostic tests. Thus during the first week of the quarter the students were grouped into four categories--i) those who can take Math 101 and are in need of two quarters of pre-college preparation in mathematics, ii) those who can take Math 101 and Math 105 in one quarter, on an accelerated basis, mostly during summer quarter, (During summer '76, a total of 35 minority students from area high schools participated in this intensive study program), iii) those who can take Math 105 and iv) those who can take GSM 144 with special assistance from help sessions.

Remediation in English:

The data and the experience thus far accumulated demonstrate that disadvantaged students need remediation also in English, probably more urgently than in mathematics. Therefore recognition is given to the absolute necessity of acquiring capability in reading and writing skills. In QMA it is "axiomatically accepted that the student must have writing skills and reading-speed satisfactory to the English Department before he can perform rewardingly in any academic program." Remediation in English is accomplished through an independent program in Developmental English which forms a necessary adjunct of QMA.

Instructional Process and Modules:

The mode of instruction in QMA(as elaborated in reference 8) is a combination of conventional lecturing with built-in workshop sessions. It provides routine access to help sessions to students who are identified in response to their performance in weekly tests. Tutorial facilities are provided on request. Basically, a class of about 40 students is conducted by one instructor and two assistants. The class period of 50 minutes is utilized in two phases--a regular lecture of about 30 minutes by the instructor and a follow-up and routine workshop session of about 20 minutes. During workshop sessions students are encouraged to solve a set of problems and to discuss their individual difficulties either with the instructor or with one of the assistants. In addition to lectures, the instructor is

responsible for the distribution of modules (most of which are ready-made), appraisal of students' performances, and arrangement of help sessions. These modules or units are supplementary materials on isolated topics, e.g., modules on least common denominators, exponentials, etc. Emphasis is given to applications of arithmetic and algebra to problems in physical and health sciences and also in business administration. For details, see references 7 and 8. It is further emphasized that examples in the modules should not be routine and drill-type which add to the "demeaning and deleterious nature of the standard approach to mathematical remediation.[9] The language of the modules is intentionally the simplest possible with minimal demand on verbal skills. The problem of heterogeneous background of students is treated by a two-pronged approach--i) use of modules during help sessions and as additional reading materials, ii) providing intensive tutoring and help sessions during the first three weeks of the quarter. Our experience shows that most of the students with poor performance record in diagnostic tests and early quizzes can catch up with the rest of the class.

In general, instructional process in QMA is based on the following tenets:

i) Remedial students respond well to conventional lecturing approach which has the 'humanizing effect' of an instructor.[10] By comparison to other modes of instruction, e.g. programmed instruction, etc., this humanizing effect significantly influences the performance of remedial students who are ill prepared both in mathematics and English.

ii) The problem of heterogeneous background of students is no justification to resort to programmed instruction with the help of so-called 'self-learning kits' like video-tapes, etc.[7,8]

iii) Exercises must include problems of applied interest which can be introduced to students as project-type problems, rather than drill-type.[7-10]

iv) The demands on the verbal skills should be minimal to understand the text, which the instructor follows closely, and the supplementary materials.[7,8,10]

The Science-Engineering Club:

The preceding program, its format and mode of approach, are intended to reach disadvantaged students and to prepare them to take basic courses in science and engineering. However, its economic feasibility and long-range viability also require satisfactory and sustained level of enrollment in such courses. Concerning enrollment, efforts are being made to increase the coordination with area high schools, mostly from economically disadvantaged school districts. There are two aspects to this coordination. The first is to initiate a periodic counselling when the student has yet to complete 2 to 3 years of high school training. The second is to invite these students to visit the campus, preferably to participate in club activities where they could meet club members and invited guests who might be examples worthy of emulation. The Science-Engineering Club established in Spring 1974 is the centre of this coordination, which will serve as a means to follow-up initial recruiting efforts in science and engineering.

Since recruiting facilities, including some form of counselling, are already available, since a specially designed science program is being implemented, the question arises whether or not this club is required. The past recruiting experience and the feedback from the programs thus far implemented show that there is an 'unawareness' problem, particularly among minority students. Many of these students are experiencing considerable difficulties in developing a 'feel' towards specialized science areas. In large measure, they are unaware of the future opportunities of projected statistics on salary, employment potentials, the need for minority personnel, etc. Therefore the process of follow-up recruiting during freshman years is a crucial one, which could be designed to provide an orientation towards science and engineering.

Most of these students have come from a complex academic and socio-economic stratum which significantly contributes to this 'unawareness' situation. It is unrealistic not to recognize this fact while devising the learning system referred to earlier. "Relatively few disadvantaged students who have gained admission to university-wide special programs have chosen engineering as a field of study....Other factors specific to the disadvantaged group include unfamiliarity with engineering, perception of curriculum as a difficult one for which they do not feel adequately prepared and an image of engineering as a "white" profession in which they might not be welcome. To encourage more disadvantaged students to seek an engineering education, more compensatory and

motivational programs aimed specially at engineering and at these preconceptions are needed."[4]

This club is designed to meet the challenges of this 'unawareness' problem. Accordingly, the club activities include i) initiating informal discussions on science-related subjects with the help of documentary movies and trips to SIU-E laboratories and local industrial plants, ii) inviting professionals to meet and speak to these students about science and engineering, iii) recruiting more advanced club members as tutors and as associates in recruiting, iv) acquainting these students with the history of distinguished scientists and engineers who once fought their way against similar (probably harder!) socio-economic odds and v) to serve as a host club for visiting disadvantaged students from high schools and junior colleges. Finally this club is providing an uninhibited atmosphere where our young visitors from high schools and other institutions can meet with their senior friends and alumni who are now host members and who are now determined to seek careers in science and engineering.

5. Summary Remarks

The preceeding study is basically intended to provide insights into questions such as:i) Why we should have 'compensating and motivational' programs for disadvantaged students?, ii) What has been done at SIU-E towards initiating and implementing such programs?, iii) How does short-term statistics attest to initial program objectives? With the help of data an attempt is made here to show that disadvantaged students can successfully compete in the regular mathematics curriculum program of the School of Science and Technology. It is reiterated that the developed learning system is based on the tacit assumption that "what these students lack in preparation is more than compensated for by desire to overcome their deficiencies, a willingness to tackle new topics, and a rich potential that hitherto had hardly been tapped."[9]

As stated in the summary, topics for continued study concern i) an extension course program for area high school students with full college credit and ii) a science awareness program in high schools. With the benefit of short-term and long-term statistics it is intended to show how APST has enabled some graduates from urban high schools, to take calculus in the freshman year and complete it successfully, and to seek careers in science and engineering.

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Appendix 1

Discussion of Preliminary Results in Preparatory Mathematics

One section of Math 101 in Fall 1973, followed by two sections of Math 105 in Winter 1974 was conducted according to QMA. For comparative purposes, we include results from other sections of Math 101 in which a conventional lecturing method was used. Therefore, the data and comparisons which follow are of a preliminary nature, being based on short-term results. Since Fall 1974, all the sections of Math 101 and Math 105, comprising about 400 students, have been conducted according to QMA. (The feasibility of a digital system for detailed data acquisition and analysis is presently being investigated.)

A few explanatory remarks on the subsequent data discussion are in order. The difference between the total 10th-day enrollment of eligible students and the total number taking the final is defined here as the (total) attrition. Therefore, while computing the attrition in Math 105 we did not include those enrolled students who failed in Math 101 which is the prerequisite for Math 105. The mean standard score including percentile rank in American College Testing in Mathematics is abbreviated as ACTM score. For example, a mean standard score of 21 is the 63rd percentile, collectively denoted as 21 (PR 63). From the ACTM standard score we calculated the percentile ranks at the national level using "ACT on the Campus 1974-75." Although different sections of Math 101 in Fall 1973 and Math 105 in Winter 1974 were taught by different instructors, the data are comparable in that the same coverage of materials, identical weekly, mid-term, and final examinations were given and graded on a uniform basis. The data in the sequel is presented for three categories--with respect to the total enrollment and with respect to students from minorities and from SIP. For the purpose of the present discussion, the SIP students can be classified as financially

disadvantaged. No specific details are included to identify those students who are from minorities but who do not belong to SIP. Certain comparative evaluations concerning attrition and percentage of passing, etc. of the past 1 to 2 years are based on data collected informally from several instructors of Math 101 between Fall 1971 and Spring 1973 and of GSM 144 since Fall 1972.

In Fall 1973, a total of 222 students enrolled in Math 101, 76 from minorities and 36 from SIP. Information pertaining to attrition, percentage of passing, ACTM scores, etc. are shown in Table 1. During the past 4 years, the ACTM average

Table 1
Math 101-4, Fall 1973

Data Genesis	Total population (5 sections)	From minorities	From SIP
No. of students enrolled	222	76	36
ACTM score	14 (PR. 26)	11.4 (PR. 16)	11.4 (PR. 16)
No. of students in the final	175	57	27
Attrition	47 (21.8%)	19 (25%)	9 (25%)
No. of students passing (%)	156 (89.1)	48 (84.2)	23 (85.2)
No. of students failed (%)	19 (10.9)	9 (15.8)	4 (14.8)
Mean score in percentages	56.9	52.6	52.1

Remarks:

1) Concerning ACTM score, 14 (PR. 26) refers to a mean standard score of 14 which is the 26th percentile rank.
2) Percentages in parentheses are relative to the total number shown in corresponding columns.
3) About 50% of students from minorities also belong to SIP.
4) Data on ACTM scores are available for 58.4% of the total population, for 54% of students from minorities and for 52.8% of SIP.
5) Results based on diagnostic tests indicate that the quoted ACTM figures are likely to be higher than the actual, had the ACTM data been available for the total population.
6) Math 101-4 is conducted on pass-fail basis only.

in percentiles (percentile rank corresponding to the mean standard score) was close to the 50th at the national level and also with respect to SIUE-bound freshmen. However, the number of SIUE-bound freshmen in the lower one-third of the ACTM percentile ranks varies from 400 to 500; for example, in 1972-73 it was 450. The ACTM average is equal to 14 (PR 26) with respect to total enrollment in Math 101, and equal to 11.4 (PR 16) with respect to students from SIP or from minorities. These averages for Math 101 are based on the available ACTM data as detailed in remark No. 4 of Table 1. The attrition rate with respect to the total population is approximately comparable to that of SIP and the minority students, 21.8% compared to 25%. It is much less than the corresponding figures of the past 1 to 2 years, which varied from 40 to 60% for SIP students and from 30 to 40% with respect to the total enrollment. The percentage of students passing is 85.2 for SIP and 84.2 for students from minorities, which is also comparable to the total percentage of passing of 89.1. Here, also, we observe a marked improvement since the total percentage of passing of the past 1 to 2 years varied between 40 and 60.

It is worth mentioning that among 5 sections of Math 101 during Fall 1973, only one section (section 3) was conducted using QMA. We now present certain comparative data with respect to another section in which a conventional classroom approach was used. The selection of such a section to be used as a base for comparison was governed by three prior constraints: With respect to QMA Section 3, the enrollment had to be comparable (1) in terms of the total number of students taking the course, (2) in terms of the number of SIP and minority students in the class, and (3) in terms of comparable ACTM scores represented. Section 2 satisfied these requirements, see Table 2.

Table 2
Math 101, Fall 1973

Data Genesis	Section 2 (conventional Lecture approach)			Section 3 (Quasi-Modular approach)		
	Total No.	From Minorities	From SIP	Total No.	From Minorities	From SIP
No. of students enrolled	49	20	10	46	19	11
No. of students in the final	33	12	6	37	15	8
Attrition	16 (32.7%)	8 (40%)	4 (40%)	9 (19.5%)	4 (21%)	3 (27.3%)
• No. of students passing (%)	26 (78.8)	7 (58.3)	4 (66.7)	33 (89.2)	12 (80)	7 (87.5)
No. of students failed (%)	7 (21.2)	5 (41.7)	2 (33.3)	4 (10.8)	3 (20)	1 (12.5)
Mean final score in percentage	56.3	51.2	50	57.2	54.3	58.6
No. of students who scored above 60%	13 (26.6%)	1 (5%)	0	19 (41.3%)	6 (31.6%)	5 (45.5%)
≠ ACTM score	14.0 (PR. 26)	10.8 (PR. 14)	10.5 (PR. 14)	14.1 (PR. 26)	10.7 (PR. 14)	11.0 (PR. 15)

Remarks: 1) ≠ ACTM score is section 2 are available for 67% of the total population. But in section 3, the ACTM scores are available for 60% of the total population, for 60% of students from minorities and for 67% of SIP.

2) • Minimum passing score is 50%.

With respect to the total sample, the mean final score for section 3 is only slightly better than that for section 2: 57.2% compared to 56.3%. However, with respect to attrition and the final score distribution, the performance of section 3 (QMA) is much better than that of section 2 (traditional lectures) in four respects: 1) The attrition rate in section 3 is less than in section 2 by approximately 13 percentage units with respect to total enrollment and SIP students. The attrition with respect to minority students under QMA is almost half that in section 2; 2) 19 students, including 6 from minorities, scored higher than 60% in section 3 when compared to 13, including one from minority, in section 2; 3) significantly, 5 students from SIP (i.e., about 45% of the total SIP population in section 3 scored more than 60%, compared to none in section 2; 4) 89.2% of the students passed the final in section 3 compared to 78.8% in section 2. Similar improved trends in percentage of students passing the course are also observed with respect to students from minorities and SIP, 80% compared to 58.3% and 87.5% to 66.7%. Thus it appears that QMA is very effective in preparing disadvantaged students to achieve average and slightly better-than-average grades.

Data in Table 3 refer to Math 105, Basic Mathematics, for Winter and Spring 1974. The total 10th-day enrollment of 164 students includes 18 from SIP and 49 from minorities. In all sections, QMA was used in both quarters. The total attrition is approximately comparable to that of SIP, 26.2% compared to 22.2%, and slightly higher for minority students. The percentage of students from SIP passing the course is also comparable to that of the whole class, 92.8% compared to 88.4%. For students from minorities, the percentage of passing is 81.8%, about 7 percentile units less than the total.

Table 3
Math 105-4, Winter & Spring 1974

Data Genesis	Total Population	From Minority	From SIP
No. of students enrolled (10th day list)	164	49	18
No. of students in the final exam	121	33	14
Attrition (%)	43 (26.2)	16 (32.6)	4 (22.2)
No. of students passing in percentage	107 (88.4)	27 (81.8)	13 (92.8)
No. of students who obtained			
Grade A (%)	26 (24.3)	4 (14.8)	1 (7.7)
Grade B (%)	34 (31.8)	7 (25.9)	5 (38.5)
Grade C (%)	32 (29.9)	11 (40.7)	6 (46.2)
Grade D (%)	15 (14)	5 (18.5)	1 (7.7)
Grade E	14	6	1

The grade distribution shows that 56.1% of the students passed the course with a grade of B or better, which includes 46.2% from SIP and 40.7% from the minorities. Table 3 also shows that 29.9% students including 46.2% from SIP and 40.7% from minorities passed the course with a grade of C. These students with a grade of C or better should be adequately prepared to take GSM 144, College Algebra. The performance of students in College Algebra, which is the first regular Mathematics course at SIUE, is discussed in detail in Appendix 2.

Appendix 2

A Comparative Overview of Post-Remediation

In Appendix 1, we appraised the performance of a group of students completing two courses in preparatory mathematics (Fundamental Mathematics, Math 101, followed by Basic Mathematics, Math 105) from Fall 1973 to Spring 1974. This appraisal, on the basis of the data presented in Tables 1-3*, indicates that the QMA instructional process is effective in reaching disadvanataged students. We use the term "QMA student" to designate those students who have completed both Math 101 and Math 105, or Math 105 only, in which Quasi-Modular instruction was used. The program is designed in such a way that students completing Math 105 should have adequate prerequisites to take College Algebra (GSM 144). In this report students designated as SIP students are, for the most part, also financially disadvantaged. Further, no subclassifications are included to identify those students who are from minorities but who do not belong to SIP. Since the intent of the program is to motivate students in science and engineering, the data pertaining to attrition and to the percentage of students passing the course with a grade of B or better are emphasized throughout.

We now assess the performance of about 62% of the students from this group** who took College Algebra in the Spring and Summer of 1974. The remaining students from this group are expected to take College Algebra during the 1974-75 or 1975-76 academic years. This assessment is of particular interest for two

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*Tables 1-3 are in Appendix 1.

**Observe that 107 students, as noted in Table 3, completed Math 105 under QMA.

reasons: First, College Algebra, at SIU-E, is the first "regular" course in mathematics; it is one of the General Studies courses in the science area. Second, as in other mathematics courses, it is taught by conventional lecturing methods, the average class size being close to 40. Different sections, though taught by different instructors, are coordinated by a faculty member to ensure a uniform standard with regard to homework, test assignments, and grading.

Based on the 10th-day enrollment list, a total of 341 students took College Algebra in the Spring and Summer of 1974. As presented in Table 4,

Table 4
College Algebra (GSM 144) Spring and Summer '74

Data	Total Students in GSM 144	Category 1			Category 2			Category 3		
		Taking College Algebra Directly			Taking College Algebra after completing Math 101 & 105			Taking College Algebra after completing Math 101 only		
		Total in Class	Minority	SIP	Total	Minority	SIP	Total	Minority	SIP
Total enrolled	341	245	26	17	67	21	10	29	6	3
Attrition (%)	94 (27.6)	79 (32.2)	15 (57.7)	10 (58.8)	6 (9)	2 (10)	1 (10)	9 (31)	1 (16)	1 (33)
Appeared for final	247	166	11	7	61	19	9	20	5	2
Passed (%)	240 (97.2)	160 (96.4)	10 (90.9)	6 (85.7)	60 (98.4)	18 (94.7)	9 (100)	20 (100)	5 (100)	2 (100)
Grade Distribution										
A Grade (%)	77 (32.1)	59 (36.8)	0	0	15 (25)	3 (16.7)	0	3 (15)	0	0
B Grade (%)	51 (21.2)	29 (18.1)	3 (30)	2 (33)	17 (28.3)	3 (16.7)	2 (22.2)	5 (25)	1	0
C Grade (%)	69 (28.8)	47 (29.4)	4 (40)	1 (16.7)	16 (26.7)	6 (33.3)	2 (22.2)	6 (30)	2	1
D Grade (%)	43 (17.9)	25 (15.6)	3 (30)	3 (50)	12 (20)	6 (33.3)	5	6 (30)	2	1
E Grade	7	6	1	1	1	1	0	0	0	0

Remarks:
1) Percentage of passing is based upon the total number of students taking the final.
2) Percentage of students at each grade level is based upon total number passing the course (i.e., a grade of D or better).
3) Attrition is the difference between the total enrolled (10th day) and the total appeared for the final.

these students are classified into three categories:

1) 245 students, including 26 from the minorities and 17 from SIP who took no preparatory mathematics at SIU-E;
2) 67 students (62% of 107) including 21 from the minorities and 10 from SIP who had completed Math 101 and Math 105 from Fall 1973 to Spring 1974;
3) 29 students including 6 from minorities and 3 from SIP who had completed Math 101 only.

In the discussion of data in Table 4, the performance of students in category 2 is compared with that in category 1 concerning attrition and grade distribution. Category 3 represents a very small sample of students who took College Algebra without taking Math 105. Further, it is assumed that at least a C-grade is required to successfully complete the next sequential courses in mathematics, although a grade of D will suffice to pass the course. Therefore, the data related to D-grade distribution and to category 3 are included here for completeness only.

In category 1, the attrition is 32.2% with respect to the population of 245 students; it is 57.7% and 58.8% for minority and SIP students respectively. The corresponding attrition figures in category 2 are 9% with respect to the total population of 67 students, and 10% for both minority and SIP students. Thus, it is seen that the attrition in category 2 with respect to the total population is reduced by about 23 percentile units when compared to the corresponding attrition rate in category 1: 9% compared to 32.2%. Still more noteworthy is the corresponding reduction in attrition with respect to minority and SIP students: 57.7% reduced to 10%, and 58.8% to 10%.

The percentage of passing is computed with respect to the total who took the final examination, which is taken as a means of quantifying the overall performance. It is 97.2 with respect to the total of 247 (166 + 61 + 20)

students. With respect to the corresponding total populations in categories 1 and 2, it is 96.4 and 98.4, respectively. Thus, we observe that the overall performance of students in category 2 is slightly better than of those in category 1.

Referring to the total enrollment of 341 students, 53.3% (32.1% + 21.2%) had a grade of B or better, indicating a better-than-average performance. The corresponding figures with respect to the total population in the first and second category are 54.9% and 53.3%, respectively. Again, we observe that the better-than-average performance of students in category 2 is comparable to that of category 1 and of the total population of 341 students. It should be noted that 16.7% of minority students in category 2 obtained A grades, whereas none of the minority students in category 1 obtained an A grade. Concerning the average performance expressed in terms of C-grade distribution, the performance of students with respect to the total population in category 2 is comparable to that in category 1: 29.4% compared to 26.7%. Thus, in summary, results in Table 4 indicate that the performance of students in category 2 by comparsion to category 1 is significant in the following respects:

a) Reduced attrition, particularly noteworthy with respect to minority and SIP students;

b) Better-than-average performance (a grade of B or better);

c) The relatively high percentage of minority students making A grades;

d) The comparable number of average students (i.e., those making a grade of C).

Finally, we touch upon the following question: How does the preceding appraisal on the basis of data in Table 4 compare with corresponding data prior to the inception of the present program? As stated earlier, the remediation program in its present format was started in Fall 1973, and Math 105 was introduced for the first time in Winter 1974. Therefore, the effect of the present

program upon students' performance in college algebra will be from Spring 1975 onward only. No comparable data prior to Winter 1974 are available except those in Table 5. Though limited in scope, the data in Table 5 are noteworthy since they depict a typical situation existing prior to the inception of the

Table 5
College Algebra, GSM 144 Winter 1974

Data	Total population	Category 1 Students taking College Algebra directly		Category 3 Taking College Algebra after Math 101	
		Total Students	SIP	Total Students	SIP
Students enrolled 10th day	297	222	13	75	13
Total appeared for the final	200	146	5	54	7
Attrition (%)	97 (32.7)	76 (34.2)	8 (61.5)	21 (28)	6 (46.2)
Total passed (%)	193 (96.5)	140 (95.9)	5 (100)	53 (98.2)	7 (100)
Grade Distribution					
A Grade (%)	48 (24.9)	45 (32.1)	0	3 (5.7)	0
B Grade (%)	38 (19.7)	28 (20)	0	10 (18.9)	1 (14.3)
C Grade (%)	64 (33.2)	42 (30)	3 (60)	22 (41.5)	3 (42.9)
D Grade (%)	43 (22.3)	25 (17.9)	2 (40)	18 (34)	3 (42.9)
E Grade	7	6	0	1	0

present program. According to the criteria of categorizing in Table 4, there are two categories of students in Table 5:

1) Category 1 represents 222 students, including 13 from SIP, who took college algebra directly without any remedial preparation at SIU-E;

2) Category 3 represents 75 students, including 13 students from SIP, who took college algebra after completing Math 101.

Now, we compare the performance in college algebra of students in category 2 in Table 4 with those in category 1 in Table 5. This comparison is noteworthy in the following respects:

1) The attrition rate with respect to the total population of 222 students in category 1 in Table 5 is 34.2%; in category 2 in Table 4, it is only 9% with respect to 67 students;
2) For both groups of students, and with respect to the total population, the percentages of students passing--and of students passing the course with a grade of B or better--are comparable: 95.9 in category 1 in Table 5 compared to 98.4 in category 2 in Table 4, and 52.1 (32.1 + 20) in category 1 in Table 5 compared to 53.3 (25 + 28.3) in category 2 in Table 4.
3) A significant improvement is observed with respect to SIP students who had QMA instruction as compared to SIP students under the former method of instruction. In category 1 in Table 5, the attrition rate is 61.5% with respect to 13 SIP students, and in category 2 in Table 4, it is only 10% with respect to 10 SIP students who had the QMA in Math 101 and Math 105.
4) None of the SIP students in category 1 in Table 5 obtained a grade of B or better, whereas in category 2 in Table 4, 22.2% of SIP students obtained B or better grades.

Although 67 students in category 2 in Table 4 did complete two quarters of training in remedial mathematics under QMA, it is still instructive to compare the performance of these students with the performance of 75 students who completed Math 101 with traditional instruction (category 3 in Table 5). Such a comparison should give some indication of how effective Math 105 is in preparing

disadvantaged students to take college algebra. The following are the salient features of such a comparison:

1) In category 2 in Table 4 the attrition rate is 9% with respect to all 67 QMA students, and 10% with respect to 10 QMA students from SIP. These figures should be compared with an attrition rate of 28% with respect to a total of 75 non-QMA students, and 46.2% with respect to 13 non-QMA students from SIP in category 3 in Table 5. Thus, we observe a significantly reduced attrition in college algebra with respect to students taught Math 101 and 105 by QMA when compared to students taught Math 101 by traditional methods--an attrition reduction of 19 and 36.2 percentile units with respect to the total population and SIP students respectively.

2) The percentage of students passing the course with a grade of B or better is 53.3 with respect to 67 QMA students in category 2 in Table 4. It is approximately 30 percentile units higher than the corresponding figure in category 3 in Table 5, i.e., 53.3% compared to 24.6% (5.7 + 18.9).

3) Concerning the percentage of SIP students obtaining a grade of B or better, we have in category 2 in Table 4, 22.2 in college algebra following Math 101 and Math 105 under QMA, and in category 3 in Table 5, 14.3 in college algebra following Math 101 under traditional instruction--approximately an improvement of 8 percentile units.